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4.2 CALIBRATION AND VERIFICATION OF THE EVERGLADES AND THE LOWER EAST COAST

This section presents the results of the calibration and verification for the gridded model domain outside of the Everglades Agricultural Area (EAA) including: the Water Conservation Areas (WCAs), the Big Cypress National Preserve (BCNP), Everglades National Park (ENP), the Holey Land and Rotenberger Wildlife Management Areas, and the Lower East Coast Service Areas (LECSAs).

4.2.1 Methodology

The primary goal of the SFWMM calibration and verification procedure for the majority of the model domain (LEC, WCAs, ENP, and BCNP) was to determine appropriate values for the many physically based parameters used by the model in order to ensure that the tool can reproduce the historically observed response of the South Florida system. In order to achieve this goal, historical water level observations from a network of ground and surface water monitoring locations maintained by the South Florida Water Management District (SFWMD or District) and the U.S. Geological Survey (USGS) were used to make stage comparisons during calibration (Figure 4.2.1.1). Simulation was performed on a daily basis and simulated water levels were compared with historical data on a daily basis for marsh or groundwater gage locations and on an average weekly basis for canal locations. Since the primary goal of calibration was to determine physical, not operational parameters, matching to structural flow was not considered in the determination of calibration parameters. A breakdown of the most significant parameters refined or determined by the calibration procedure is given below.

1. Lower East Coast
    a. Canal parameters
        i. Channel - aquifer hydraulic conductivity coefficient [CHHC in Equation (2.5.2.1)]
        ii. Surface water - channel interaction [N in Section 2.6]
        iii. Coefficients for operation of outlet structures
    b. Detention depths (refer to Section 2.4)
    c. ET coefficients (KVEG, DSRZ, DDRZ in Section 2.3)
2. Everglades (WCAs, ENP and BCNP)
    a. ET coefficients (KVEG, DSRZ, DDRZ in Section 2.3)
    b. Effective roughness N ($N = Ah^b$ for overland flow; mainly A is adjusted)
    c. Levee seepage rate coefficients [β_0, β_1, β_2 in Equation (2.5.3.1)]
    d. Detention depths (refer to Section 2.4)
    e. Canal parameters (refer to Sections 2.5 and 2.6)

Because the period of record available for modeling spans 36 years, the record could be divided into periods for both calibration and verification. The period used for calibration was from January 1, 1984, to December 31, 1995. Due to operational and structural changes in the Central and South Florida Flood Control (C&SF) Project around 1990, the calibration period was further broken into two sub periods: 1984 to 1990 (using operations for the 1980's) and 1991 to 1995 (with operations for the 1990's). The verification record spanned two time periods: January 1, 1981, to December 31, 1983; and January 1, 1996, to December 31, 2000. Determining periods when few system changes occurred and where hydrologic variability was well represented were important considerations in addition to the normal concerns for data integrity. In the earlier years of the calibration/verification period, the operations of water control structures may have involved some field-level decision-making. During the later years, in contrast, decision-making was fully centralized, which in turn followed operating manuals more closely.

To help account for variation in operation practices, as a general rule, available time series of historical structure flows were input to the model as internal boundary conditions between different hydrologic basins. The use of historical flows as internal boundary conditions at structures (instead of simulated flow through those structures) allowed physically based processes to be calibrated without being affected by possible changes to operating practices over time. In general, the flow records at many of the structures throughout the system were complete with high quality data. In some cases, particularly in some Lower East canals, internal structures were simulated rather than imposed during the calibration and verification periods. This practice was applied only where historical data was sparse and/or not available, where the quality of the data was poor or where the model representation of the contributing runoff basin was significantly different than what was in the field due to issues of scale. For many of these flow locations, as shown in Figure 4.2.1.2, reasonability checks are made on monthly, seasonal and annual bases to verify simulated flows against available historical data. These checks were not used in helping to determine calibrated parameters, but rather led to changes in the structural operational assumptions used for the calibration and verification runs.

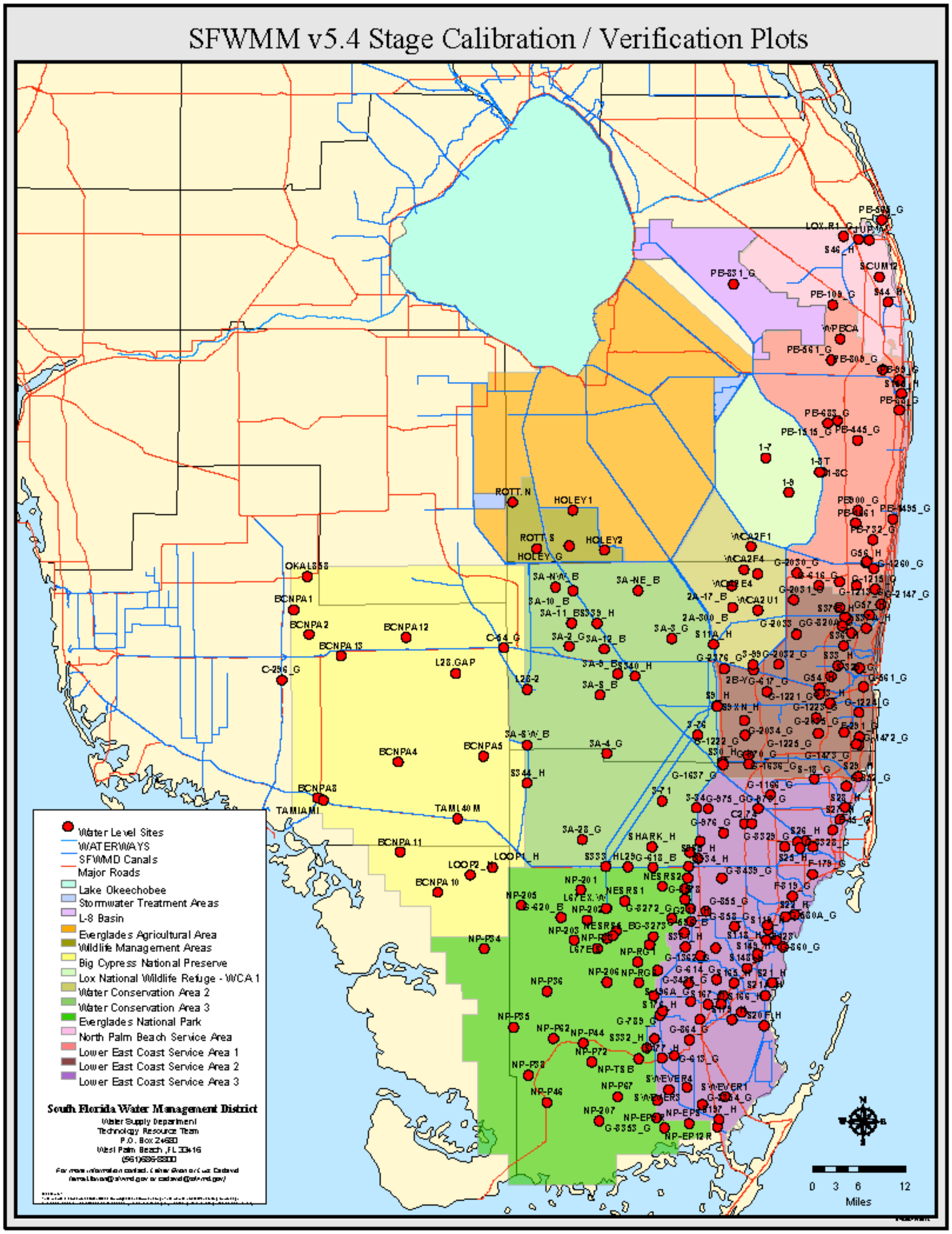

Figure 4.2.1.1 Location of Stage Calibration and Verification Sites

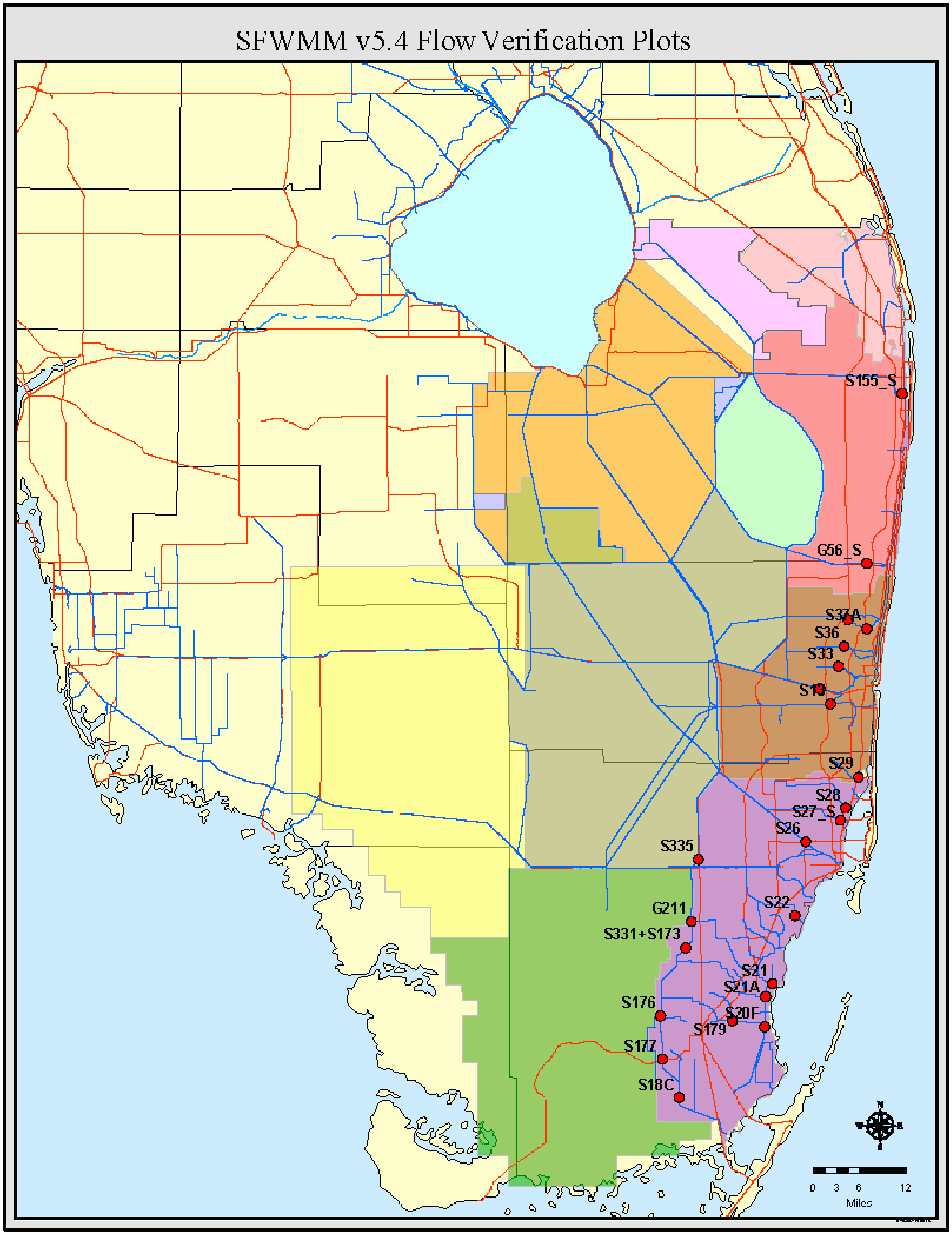

Figure 4.2.1.2 Locations of Flow Validation Sites

Calibration Procedure

Calibration was performed in an iterative fashion: (1) simulated stages were compared with historical stages at selected monitoring points and simulated flows were compared with historical flows at selected control structures; (2) appropriate calibration parameters were modified in order to make simulated values match historical values more closely; (3) the model was rerun with the revised parameters; and (4) steps 1 through 3 were repeated until an acceptable match between simulated and historical values was obtained.

The general guidelines used in calibrating the model were discussed in Section 4.1. Additional guidelines specific to the Everglades/LEC region are listed below.

1. The calibration period covered historical data consistent with a relatively static network of canals and water control structures, and constant structure operating rules.
2. Local parameters such as canal properties and cell-based data were adjusted before regional parameters were adjusted. Regional parameters such as land use type have influence over a greater area. This procedure was followed to minimize the undesirable effect of the calibration getting better in some areas but negatively affecting other areas in the model domain.
3. The ET-Recharge model was re-run for several snapshots of land use. The 1988 FLUCCS land use coverage was used as input to the ET-Recharge model for the 1984-1995 calibration period and the 1981-1983 verification period. The 2000 FLUCCS coverage was used for the 1995-2000 verification period.
4. It was shown (Trimble, 1995a) that canals heavily influence groundwater levels within their immediate proximity. The monitoring point closest to the canal, assuming that several observation points exist within the cell where the canal is located, is given priority for the stage matching. This allows for a better representation of the canal-groundwater interaction.

In order to determine the "acceptability" of a calibration run, many statistical measures and individual time series plots were used to help assess model performance. These will be shown in more detail in Section 4.2.2. In addition to comparing seasonal and annual sums and means, the following statistical measures and their corresponding ranges were used to evaluate the status of the calibration after each parameter change.

Coefficient of determination or correlation coefficient, R^2:

$$R^2 = \left[\frac{\sum_{i=1}^{n} (x_i - x_m)(\hat{x}_i - \hat{x}_m)}{\sqrt{\sum_{i=1}^{n} (x_i - x_m)^2 \sum_{i=1}^{n} (\hat{x}_i - \hat{x}_m)^2}} \right]^2 \qquad 0 \le R^2 \le {}^{+}1 \qquad (4.2.1.1)$$

Root mean square error, rmse:

$$rmse = \sqrt{\frac{\sum_{i=1}^{n}\left(\hat{x}_i - x_i\right)^2}{n-1}} \qquad 0 \le rmse \le {}^{+}\infty \qquad (4.2.1.2)$$

Bias:

$$bias = \frac{\sum_{i=1}^{n}\left(\hat{x}_i - x_i\right)}{n} \qquad -\infty \le bias \le {}^{+}\infty \qquad (4.2.1.3)$$

Nash-Sutcliffe Efficiency:

$$Eff = 1 - \frac{\sum_{i=1}^{n}\left(x_i - \hat{x}_i\right)^2}{\sum_{i=1}^{n}\left(x_i - x_m\right)^2} \qquad (4.2.1.4)$$

where:

- n = number of data points
- x_i = observed data point
- x_m = mean of observed data points
- $\hat{x}_i$ = simulated data point
- $\hat{x}_m$ = mean of simulated data points

The Nash-Sutcliffe Efficiency can also be expressed as:

$$Eff = 2\,R\,\frac{S_{\hat{x}}}{S_x} - \frac{bias^2}{S_x^{\,2}} - \frac{S_{\hat{x}}^{\,2}}{S_x^{\,2}} \qquad (4.2.1.5)$$

where the standard deviation for the historical (S_x) and estimated ($S_{\hat{x}}$) data are:

$$S_x = \sqrt{\frac{\sum_{i=1}^{n}(x_i - x_m)^2}{n-1}} \qquad (4.2.1.6)$$

$$S_{\hat{x}} = \sqrt{\frac{\sum_{i=1}^{n}(\hat{x}_i - \hat{x}_m)^2}{n-1}} \qquad (4.2.1.7)$$

All comparisons using the above statistical measures were performed by limiting the number of data points by the size of available historical data. In other words, simulated data with no corresponding historical data were not considered in the statistical calculations. As a result, statistics generated from different sample sizes (varying from less than 100 to over 4000) were considered.

When comparing historical data with simulated values, several factors beyond the statistical matches were also considered. As a general rule, good engineering judgment must be used to supplement the information provided by the calibration statistics and plots. These included the following:

1. Exact matching of historical data may not be desirable in some cells during the calibration process. The simulated stage represents the average water level computed for a 4 square mile area. Comparing historical stage, a point measurement, against simulated stage, an estimated areal average, is a source of discrepancy in itself. As an example, if there is significant well pumpage in close proximity to the gage, the observed data can be strongly influenced; whereas the average effect of the well pumpage (over 4 square miles) can be fairly minimal. Similarly, a gage located next to a canal would show more variability in measured values than an average stage from a 4-square-mile cell, although in other cases it may be more desirable to use such a gage to better represent the canal-groundwater interaction.
2. The spatial resolution of the model, 2-miles by 2-miles, is too coarse for modeling local phenomena such as wellfield drawdowns and levee seepage.
3. The time resolution of the model, 1 day, may not always satisfy certain assumptions in the model. For example, in the overland flow subroutine, in order to maintain stability in the solution procedure, volume constraints during some simulation days may override the assumption that overland flow is a diffusion type process.
4. The scale of the model must also be considered in making stage comparisons in canals. The mean simulated stage over a two mile (or longer) reach may not be directly comparable to a point measurement on the canal just upstream of a water control structure.
5. When interpreting how well the model is matching the observed data, considerations must be given for the accuracy of the observed data. In some cases, observed data are known to reflect deviations from normal operating policy, such as pre-storm drawdowns, and would therefore not match the predicted values by the model. The model has time-varying rules of operation only for outlet structures of reaches with daily variation in simulated canal slope (dynamic canal slope option), where the criteria vary from normal condition to flood condition depending on antecedent rain. In some cases, the observed data was considered to be generally reliable, but suspect for a specific time period (based on comparisons with neighboring gages and hydro-meteorological responses).

As previously stated, the iterative calibration procedure was followed with consideration for the many statistical, graphical and anecdotal metrics refining model parameters for the local to regional scale. Once little or no improvement in history matching was observed with additional changes in parameters, the calibration effort was deemed complete. The next section discusses the results of the SFWMM v5.4 calibration and verification. With minor changes, v5.4 will become v5.5.

4.2.2 Calibration and Verification Results

Table 4.2.2.1 shows the calibration and verification statistics for the WCAs, the ENP, BCNP, Holey Land and Rotenberger WMAs, and the LECSAs. Because the full set of maps and figures showing the time series data at individual sites is so large, the maps and figures are provided in Appendix C. Examples of time series graphics are illustrated in Figures 4.2.2.1 and 4.2.2.2. When interpreting how well the model is matching the observed data, considerations must be given for the many issues of scale and data accuracy as outlined in the previous section. From Table 4.2.2.1, the following observations can be made:

1. WCA-1. One canal site and three marsh sites were available for comparisons with observed data; the sampling size for both calibration and verification was good. The R^2 values ranged from 0.7 - 0.8. The bias was about 0.1 ft or less, except at one site where the bias was 0.2+ ft.
2. WCA-2A. There were six marsh stations and one canal station used for comparisons. The calibration sampling size ranged from 400 to 4,000 values. The verification sampling size ranged from about 1,500 to 2,900 values. The R^2 values for calibration were generally in the 0.7 to 0.9 range with the verification R^2 values were about 0.6 and ranging from 0.3 - 0.7. The calibration and verification bias were generally less than 0.2 ft.
3. WCA-2B. There were two marsh stations used for comparisons. The calibration and verification records were good. The R^2 values range from 0.7 - 0.8. Calibration bias averaged about 0.1 ft and the verification bias was about 0.3 ft.
4. WCA-3A. There were fifteen marsh stations and five canal stations used for comparisons. In both cases the sampling records were good. In the marsh stations, calibration and verification R^2 values range from 0.8 - 0.9 generally. In the marsh calibration, the bias range from less than 0.1 to one station being high at about 0.7 ft. The verification bias ranges from 0.1 - 0.2 ft, again with the same one station having a high bias of 0.9 ft. For the canal gages, the R^2 values range from 0.8 - 0.9 and the bias range from less than 0.1 - 0.2 ft, generally speaking.
5. WCA-3B. There were five marsh stations used for comparisons. Sampling period was good at all but one station. For the calibration, R^2 values range from 0.4 - 0.8, and the verification R^2 values range from 0.6 - 0.8. Calibration bias was generally less than 0.1 feet with one station being 0.3 ft. The verification bias ranged from 0.1 - 0.3 ft.
6. ENP. There were 34 marsh stations, 4 well stations and 1 canal site used for comparisons. They were generally good sampling sizes at all but five stations. Generally, the R^2 values range from 0.8 - 0.9 with the lowest being about 0.4. The bias stations were generally in the range of 0.1 - 0.3 ft.
7. BCNP. Seventeen marsh stations were used for comparisons. Five had good sample sizes, two were poor and the rest had fair sampling sizes. The R^2 values for calibration ranged from 0.4 - 0.9; verification R^2 values, being a little less, ranged from 0.4 - 0.8. The bias generally ranged from less than 0.2 ft up to 0.7 ft; only one station was high.
8. NPBSA. There were five well sites and two canal sites used for comparisons; four had good records and three had poor records for sampling size. Calibration R^2 values range from about 0.3 - 0.6, and the R^2 values for verification range from 0.5 - 0.7. Only one canal station had very poor R^2 readings. The bias generally ranged from 0.1 up to 1.0 ft.
9. LEC-SA1. There were two marsh stations, fourteen well stations and three canal stations

used for comparisons. Twelve sampling records were good. The R^2 values generally ranged from 0.4 - 0.7 and twelve stations had generally less than 0.2 ft bias with one site up to 0.6 ft for the calibration period. For the verification period, nine stations had less than 0.2 ft with a range up to 1.0 ft.

10. LEC-SA2. There were 29 well sites and 11 canal sites used for comparisons. The period of record was generally good with very few exceptions. For well sites, the R^2 values range from about 0.0 - 0.8. For canal sites, the calibration R^2 values ranged from 0.0 - 0.6; verification R^2 ranged from 0.2 - 0.7. The bias in all cases was generally less than 0.2 ft.

11. LEC-SA3. There were 7 marsh stations, 35 well stations and 20 canal stations used for comparisons. There was a good sampling size at all sites. For the well and marsh stations, the R^2 values generally varied from 0.6 - 0.8 both in calibration and verification. For the canal sites, the R^2 values generally ranged from 0.2 - 0.8 for calibration and from 0.1 - 0.8 for verification. In all cases, the bias was generally less than 0.2 ft with many stations being less than 0.1 ft.

General Observations

Figure 4.2.2.3 displays the calibration correlation values for the stage locations. Figure 4.2.2.4 displays the verification correlation values for the stage locations. Green symbols denote a good correlation (0.61 - 1.00). Figure 4.2.2.5 displays the calibration bias for the stage locations. Figure 4.2.2.6 displays the verification bias for the stage locations. The darker green symbols denote an acceptable bias (within $\pm$0.5 feet of observed). Sign convention (positive or negative) of the bias value is also denoted inside the symbols in gage locations shown in the maps. The following general observations can be made from Figures 4.2.2.3 through 4.2.2.6:

1. The marsh areas tend to have higher R^2 values, generally in the 0.8 - 0.9 range, while the groundwater well sites in developed areas had lower R^2 values, generally ranging from 0.4 - 0.7.
2. With some exceptions, the bias was relatively small (generally less than 0.2 ft), with many values being less than 0.1 ft. The small bias occurred in marsh areas, both in the natural areas (undeveloped) and developed areas.
3. In the developed areas, the canals generally had poor R^2 values compared to well sites or marsh sites.
4. The R^2 values for the marsh sites in the developed areas (0.5 - 0.8 range) were not as good as the marsh areas in the natural areas.

The following comments are based on a review of the figures presented in Appendix C:

1. With few exceptions, the natural marsh areas have predicted hydrographs that correlate well with observed hydropatterns.
2. The observed data for the LEC canals have greater variability than the predicted patterns. The lower stages may be due to pre-storm drawdowns, while the greater overall variability may be due to the highly managed operations.
3. The observed data in the LEC marsh and well sites correlated well with predicted hydropatterns.
4. Although flow comparisons were not used to refine model calibration parameters, the monthly flow predictions at structures did match observed data reasonably well.

SFWMM v5.4 Calibration (1984-1995) and Verification (1981-1993,1996-2000) Statistics for Stage Locations

Basin/Region	Station	Gage Type (1)	Land Use Type (2)		SFWMM		R^2		RMSE (ft.)		BIAS (ft.)		Efficiency		Sample Size	
			Calib.	Verif.	Row	Col	Calib.	Verif.	Calib.	Verif.	Calib.	Verif.	Calib.	Verif.	Calib.	Verif.
WCA-1	1-7	Marsh	RS3	RS3	48	31	0.745	0.781	0.404	0.353	-0.106	-0.072	0.570	0.549	4124	2922
	1-8C	Canal	CNL	CNL			0.736	0.791	0.728	0.556	0.046	0.090	0.694	0.781	4383	2922
	1-8T	Marsh	RS3	RS3	47	34	0.751	0.783	0.510	0.444	0.208	0.214	0.533	0.607	4028	2841
	1-9	Marsh	RS3	RS3	46	33	0.813	0.820	0.380	0.346	0.127	0.163	0.574	0.686	3939	2922
WCA-2A	2A-17	Marsh	RS3	RS3	40	29	0.901	0.663	0.332	0.529	-0.088	-0.115	0.876	0.545	4383	2922
	2A-300	Marsh	RS3	RS3	39	29	0.835	0.591	0.470	0.653	-0.150	-0.154	0.807	0.521	4112	2733
	S11AHW	Canal	CNL	CNL			0.699	0.278	0.767	1.174	-0.194	-0.283	0.285	-0.951	2902	1818
	WCA2E4	Marsh	RS5	RS5	41	31	0.885	0.644	0.349	0.578	0.033	-0.185	0.870	0.406	433	1584
	WCA2F1	Marsh	MIX	MIX	43	30	0.776	0.717	0.536	0.501	-0.237	-0.297	0.717	0.545	432	1762
	WCA2F4	Marsh	RS5	RS5	41	30	0.870	0.566	0.373	0.514	0.032	-0.155	0.841	0.357	432	1509
	WCA2U1	Marsh	RS3	RS3	39	31	0.865	0.537	0.426	0.671	0.174	0.053	0.826	0.457	433	1717
WCA-2B	2B-Y	Marsh	RS4	RS4	35	30	0.740	0.828	1.227	0.418	0.073	0.300	0.716	0.607	3688	1663
	3-99	Marsh	RS4	RS4	35	30	0.830	0.791	0.594	0.438	0.146	-0.262	0.784	0.674	1589	1749
WCA-3A	3A-10	Marsh	MIX	MIX	40	19	0.852	0.802	0.278	0.300	0.095	-0.037	0.832	0.797	3797	2648
	3A-11	Marsh	RS4	RS4	38	19	0.900	0.823	0.723	0.904	-0.689	-0.864	-0.070	-1.113	3785	2673
	3A-12	Marsh	RS4	RS4	36	21	0.594	0.783	0.538	0.353	0.021	-0.046	0.572	0.775	3755	2760
	3A-2	Marsh	RS4	RS4	36	18	0.908	0.887	0.363	0.439	-0.093	-0.265	0.876	0.755	4308	2837
	3A-28	Marsh	RS2	RS2	24	19	0.880	0.888	0.487	0.410	0.242	0.285	0.780	0.784	4383	2912
	3A-3	Marsh	RS5	RS5	37	25	0.869	0.879	0.536	0.406	0.118	-0.095	0.847	0.861	4383	2922
	3A-4	Marsh	RS2	RS2	29	21	0.916	0.931	0.352	0.278	-0.095	-0.151	0.891	0.903	4383	2922
	3A-9	Marsh	RS4	RS4	35	21	0.918	0.908	0.339	0.462	-0.161	-0.366	0.885	0.684	4383	2586
	3A-NE	Marsh	SAW	SAW	40	23	0.631	0.917	0.823	0.455	-0.052	-0.237	0.618	0.810	4150	2663
	3A-NW	Marsh	RS5	RS5	40	18	0.847	0.852	0.339	0.409	-0.024	-0.100	0.839	0.787	3860	2771
	3A-S	Marsh	RS2	RS2	33	20	0.919	0.857	0.273	0.403	-0.095	-0.261	0.905	0.741	4285	2586
	3A-SW	Marsh	RS2	RS2	30	16	0.890	0.908	0.347	0.238	-0.008	-0.081	0.797	0.870	4131	2510
	G618	Marsh	RS4	RS4	22	23	0.853	0.887	0.313	0.297	0.094	-0.101	0.837	0.838	4255	2869
	L28-2	Marsh	CAT	CAT	33	16	0.903	0.823	0.366	0.540	-0.275	-0.466	0.765	0.276	2194	1813
	L29	Marsh	RS4	RS4	22	22	0.868	0.845	0.314	0.437	-0.168	-0.296	0.814	0.638	4383	2922
	S333HW	Canal	CNL	CNL			0.815	0.871	0.616	0.410	0.039	0.214	0.681	0.818	4383	2922
	S334HW	Canal	CNL	CNL			0.856	0.877	0.370	0.325	-0.236	-0.225	0.745	0.763	4383	2922
	S339HW	Canal	CNL	CNL			0.859	0.836	0.482	0.558	0.035	-0.085	0.851	0.806	4177	2922
	S340HW	Canal	CNL	CNL			0.861	0.818	0.491	0.561	-0.215	-0.271	0.822	0.748	4366	2901
	S344HW	Canal	CNL	CNL			0.961	0.894	0.527	0.316	0.500	-0.115	0.586	0.718	354	1827
WCA-3B	3B-2	Marsh	RS4	RS4	26	24	0.435	0.757	0.450	0.426	0.119	-0.348	0.391	0.214	1604	1808
	3B-29	Marsh	RS4	RS4	26	26	0.583	0.839	0.480	0.215	0.066	0.031	0.514	0.821	992	641
	3B-3	Marsh	RS4	RS4	30	27	0.638	0.699	0.332	0.270	0.086	-0.122	0.611	0.604	1571	1819
	3B-SE	Marsh	RS4	RS4	23	26	0.840	0.606	0.685	0.567	0.310	0.350	0.715	0.321	3003	1624
	SHARK	Marsh	RS4	RS4	23	24	0.857	0.708	0.360	0.316	0.006	-0.194	0.843	0.526	4228	2301
ENP	EP12R	Marsh	MAN	MAN	5	28	0.694	0.730	0.240	0.169	-0.155	-0.087	0.441	0.631	2495	333
	EP9R	Marsh	MAN	MAN	5	25	0.817	0.809	0.216	0.213	0.066	0.007	0.761	0.444	2223	365
	EPSW	Marsh	MAN	MAN	5	26	0.766	0.745	0.340	0.411	-0.232	-0.307	0.120	-0.874	3497	1743
	G1502	Marsh	MLP	MLP	17	24	0.878	0.832	0.482	0.474	0.256	-0.215	0.830	0.782	4352	2822
	G3272	Well	MLP	MLP	19	25	0.805	0.644	0.669	0.443	0.493	0.234	0.572	0.503	488	2029

4/6/2004

Table 4.2.2.1 Calibration and Verification Statistics for the WCAs, ENP, BCNP, Holey Land and Rotenberger Water Management Areas, and the LECSAs

		Gage	Land Use Type (2)		SFWMM		R^2		RMSE (ft.)		BIAS (ft.)		Efficiency		Sample Size	
Basin/Region	Station	Type (1)	Calib.	Verif.	Row	Col	Calib.	Verif.	Calib.	Verif.	Calib.	Verif.	Calib.	Verif.	Calib.	Verif.
ENP	G3273	Marsh	MLP	MLP	17	24	0.887	0.857	0.480	0.418	0.281	-0.250	0.827	0.563	4310	1827
	G3437	Well	MLP	MLP	15	24	0.835	0.828	0.524	0.539	-0.153	-0.441	0.782	0.476	3288	1796
	G3576	Well	RS4	RS4	21	26	0.871	0.816	0.152	0.163	0.063	0.032	0.809	0.808	297	1763
	G3578	Well	RS4	RS4	20	26	0.911	0.754	0.245	0.273	0.190	0.144	0.630	0.654	259	1775
	G620	Marsh	MLP	MLP	19	18	0.840	0.920	0.431	0.158	0.079	0.044	0.719	0.907	3899	2212
	L67ES	Marsh	RS4		17	21	0.903		0.246		-0.008		0.902		1887	
	L67EXE	Marsh	RS4	RS4	19	22	0.752	0.786	0.341	0.315	0.120	-0.263	0.704	0.280	4097	1760
	L67EXW	Marsh	RS4	RS4	19	21	0.913	0.928	0.347	0.339	0.060	-0.266	0.864	0.759	4194	1833
	NESRS1	Marsh	RS4	RS4	20	22	0.812	0.700	0.299	0.217	0.127	-0.126	0.771	0.465	4205	2331
	NESRS2	Marsh	RS4	RS4	21	25	0.843	0.863	0.306	0.161	0.145	-0.059	0.764	0.823	3872	2356
	NESRS3	Marsh	RS4	RS4	21	26	0.828	0.816	0.387	0.277	0.095	-0.225	0.801	0.459	3660	1827
	NESRS4	Marsh	RS4	RS4	18	21	0.891	0.831	0.340	0.259	0.270	0.155	0.370	0.539	1054	1696
	NESRS5	Marsh	RS4	RS4	18	22	0.752	0.818	0.391	0.167	0.311	0.031	0.320	0.811	3118	1817
	NP-201	Marsh	MLP	MLP	21	19	0.869	0.861	0.351	0.425	-0.097	-0.323	0.852	0.646	3831	1875
	NP-202	Marsh	RS1	RS1	19	20	0.894	0.910	0.274	0.238	0.057	-0.138	0.887	0.861	4002	2722
	NP-203	Marsh	RS1	RS1	17	19	0.893	0.901	0.253	0.253	0.073	-0.167	0.880	0.811	3780	2354
	NP-205	Marsh	MLP	MLP	20	15	0.803	0.630	0.504	0.539	0.091	0.121	0.786	0.546	4275	2874
	NP-206	Marsh	MLP	MLP	15	21	0.839	0.838	0.630	0.468	0.367	0.188	0.756	0.807	3737	2884
	NP-207	Marsh	MLP	MLP	6	20	0.792	0.820	0.449	0.319	-0.293	-0.170	0.512	0.543	4286	2472
	NP-33	Marsh	RS1	RS1	17	20	0.881	0.854	0.361	0.219	0.264	0.010	0.734	0.801	4190	2793
	NP-34	Marsh	MLP	MLP	17	13	0.831	0.837	0.431	0.371	0.066	-0.060	0.773	0.784	4109	2864
	NP-35	Marsh	RS1	RS1	12	15	0.643	0.712	0.421	0.348	0.098	0.164	0.536	0.617	4252	2511
	NP-36	Marsh	RS1	RS1	14	17	0.800	0.889	0.340	0.181	0.118	-0.049	0.755	0.849	4138	2814
	NP-38	Marsh	RS1	RS1	9	16	0.871	0.848	0.264	0.217	-0.042	0.049	0.839	0.828	4092	2797
	NP-44	Marsh	MLP	MLP	11	19	0.801	0.800	0.675	0.560	0.088	0.140	0.785	0.785	4116	2289
	NP-46	Marsh	MLP	MLP	7	17	0.630	0.675	0.610	0.340	-0.408	-0.135	-0.010	0.465	3717	2718
	NP-62	Marsh	RS1	RS1	11	17	0.823	0.872	0.467	0.301	0.060	-0.079	0.798	0.838	3488	2636
	NP-67	Marsh	RS1	RS1	7	22	0.801	0.851	0.406	0.333	-0.238	-0.223	0.670	0.707	3964	2408
	NP-72	Marsh	MLP	MLP	9	20	0.845	0.798	0.534	0.523	-0.007	0.011	0.839	0.798	3812	2763
	NP-RG1	Marsh		MLP	16	23		0.912		0.397		0.255		0.764		1269
	NP-RG2	Marsh		MLP	15	23		0.894		0.402		0.215		0.774		1492
	NP-TSB	Marsh	MLP	MLP	9	23	0.814	0.799	0.690	0.775	-0.372	-0.548	0.612	0.465	4383	2916
	RUTZKE	Marsh	MLP	MLP	14	24	0.854	0.841	0.440	0.385	0.363	0.248	0.529	0.721	542	1827
	S332HW	Canal	CNL	CNL			0.434	0.615	0.636	0.709	0.083	0.063	-0.065	0.289	4383	2922
BCNP	BCNP10	Marsh	FWT	FWT	20	10	0.357	0.345	0.250	0.249	-0.104	-0.063	0.023	-0.310	1327	1149
	BCNP12	Marsh	FWT	FWT	37	8	0.437	0.443	0.486	0.672	-0.189	-0.115	0.329	0.364	1461	1827
	BCNP13	Marsh	FWT	FWT	36	4	0.906	0.442	0.158	0.632	-0.120	0.124	0.682	0.369	96	1827
	BCNPA2	Marsh	SAW	SAW	37	2	0.626	0.615	0.745	0.852	-0.530	-0.434	0.113	0.428	1817	1827
	BCNPA5	Marsh	FWT	FWT	29	13	0.755	0.802	0.406	0.391	-0.069	-0.156	0.535	0.732	1773	1784
	BCNPA8	Marsh	SAW	SAW	26	2	0.646	0.449	1.260	1.471	1.118	1.242	-1.776	-1.330	1798	1827
	BEARI	Marsh	FWT	FWT	39	1	0.540	0.467	0.848	0.886	-0.534	-0.393	-0.179	-0.028	1823	1827
	C296	Well	SAW	SAW	34	1	0.782	0.682	0.548	1.146	-0.310	-0.680	0.642	0.484	310	2439
	C54	Well	FWT	FWT	36	14	0.505	0.532	0.683	0.764	0.114	0.332	0.447	0.340	4378	2647
	L28.GA	Marsh	FWT	FWT	34	11	0.703	0.478	0.487	0.564	0.238	0.227	0.587	0.282	4323	2070
	LOOP1	Marsh	FWT	FWT	22	14	0.709	0.719	0.566	0.226	-0.322	-0.046	0.398	0.658	3782	1776
	LOOP2	Marsh	FWT	FWT	22	12	0.776	0.664	0.522	0.362	-0.155	0.167	0.719	0.573	3857	1828

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Table 4.2.2.1 (*cont.*) Calibration and Verification Statistics for the WCAs, ENP, BCNP, Holey Land and Rotenberger Water Management Areas, and the LECSAs

Basin/Region	Station	Gage Type (1)	Land Use Type (2)		SFWMM		R^2		RMSE (ft.)		BIAS (ft.)		Efficiency		Sample Size	
			Calib.	Verif.	Row	Col	Calib.	Verif.	Calib.	Verif.	Calib.	Verif.	Calib.	Verif.	Calib.	Verif.
BCNP	MONRD	Marsh	FWT	FWT	29	7	0.695	0.718	0.841	0.606	-0.710	-0.276	-1.156	0.525	1774	1827
	OKA858	Marsh	CIT	ROW	41	2	0.539	0.412	0.786	1.132	-0.165	0.479	0.308	0.117	1503	1761
	ROBLK	Marsh	FWT	FWT	23	8	0.711	0.672	0.405	0.669	-0.170	0.079	0.597	0.593	1830	1719
	TAMI40	Marsh	FWT	FWT	25	11	0.760	0.886	0.536	0.409	-0.201	-0.191	0.720	0.830	4373	2908
	TAMIAM	Marsh	FWT	FWT	26	3	0.678	0.609	0.837	1.071	0.524	0.727	0.464	0.268	4325	2556
HoleyLand	HOLEY1	Marsh	MIX	MIX	45	19	0.532	0.448	0.476	0.611	0.204	0.515	0.390	-0.925	1795	1646
	HOLEY2	Marsh	RS5	RS5	42	21	0.341	0.292	0.620	0.548	-0.162	0.100	0.142	0.116	1746	1750
	HOLEYG	Marsh	RS5	RS5	43	18	0.536	0.369	0.587	0.507	-0.068	0.366	0.037	-0.325	2939	1658
Rotenberger	ROTT.N	Marsh	SAW	SAW	46	15	0.218	0.539	0.730	0.652	-0.103	0.147	-0.008	0.263	2674	1482
	ROTT.S	Marsh	MIX	MIX	43	16	0.624	0.693	0.611	0.465	-0.428	-0.230	-0.332	0.585	2806	1687
NPBSA	JUP.W	Well	FUP	MDU	62	38	0.666	0.514	0.721	0.905	-0.012	-0.214	0.660	0.483	163	34
	LOXR1	Well	FUP		63	36	0.603		0.374		0.031		0.567		1435	
	PB109	Well	FWT	FWT	58	36	0.495	0.759	0.892	0.495	0.426	-0.002	0.287	0.723	2775	1095
	PB565	Well	LDU	MDU	64	39	0.263	0.545	1.737	1.274	0.997	0.417	-0.391	0.275	4283	2912
	S44HW	Canal	CNL	CNL			0.079	0.008	0.205	0.267	-0.159	-0.018	-1.886	-0.073	4349	2866
	S46HW	Canal	CNL	CNL			0.628	0.467	0.733	0.606	0.395	0.246	0.301	0.362	4363	2922
	SCUM	Well	FUP	LDU	60	39	0.566	0.545	0.937	1.347	-0.106	-1.075	0.543	-0.579	93	33
LEC-SA1	E3HW	Canal	CNL	CNL			0.223	0.077	0.285	0.246	-0.158	0.005	-0.147	0.074	4229	2468
	G1213	Well	LDU	MDU	40	36	0.755	0.626	0.528	0.644	-0.019	0.110	0.752	0.614	4378	2816
	G1260	Well	HDU	HDU	41	38	0.847	0.733	0.755	0.932	0.117	-0.305	0.822	0.697	4380	2919
	G1315	Well	MDU	MDU	40	37	0.705	0.702	0.751	0.744	0.060	-0.062	0.673	0.488	4303	2816
	G2030	Well	CIT	MDU	41	33	0.445	0.504	0.571	0.750	0.203	0.042	0.278	0.237	2036	1095
	G56HW	Canal	CNL	CNL			0.047	0.033	0.946	1.240	0.029	0.002	-0.358	-0.197	4383	2922
	PB1495	Well	MDU		44	39	0.676		0.511		-0.136		0.636		2933	
	PB1515	Well	LDU		51	36	0.705		0.521		-0.180		0.517		611	
	PB1661	Marsh	LDU	MDU	44	37	0.770	0.785	0.530	0.438	-0.444	-0.329	0.229	0.499	2179	1746
	PB445	Well	ROW	MDU	49	37	0.276	0.356	0.458	0.562	0.014	0.325	-0.055	-0.439	4340	2823
	PB561	Well	LDU	MDU	55	35	0.658	0.587	0.932	0.902	0.128	0.062	0.642	0.499	4326	2830
	PB683	Well	LDU	LDU	51	35	0.592	0.625	0.933	0.954	-0.658	-0.726	0.096	0.059	4279	2856
	PB732	Well	MDU	MDU	43	38	0.804	0.656	0.454	0.670	-0.020	0.011	0.764	0.592	4253	2681
	PB809	Well	HDU	HDU	54	39	0.697	0.543	0.743	1.334	0.473	1.002	0.221	-0.134	4305	2887
	PB88	Well	HDU	HDU	51	40	0.376	0.703	1.098	1.265	0.385	0.085	0.184	0.686	3146	809
	PB900	Well	ROW	MDU	45	37	0.460	0.437	0.422	0.425	0.179	0.139	0.130	0.039	4271	1422
	PB99	Well	MDU	MDU	53	40	0.701	0.792	0.658	0.610	-0.092	-0.085	0.547	0.661	4320	2779
	S155HW	Canal	CNL	CNL			0.154	0.163	0.339	0.407	-0.217	-0.281	-1.276	-1.019	4225	2308
	WPBCA	Marsh	MAR	MAR	56	36	0.511	0.719	0.592	0.991	-0.037	-0.828	0.489	-2.697	564	1227
LEC-SA2	F291	Well	MDU	MDU	30	37	0.794	0.804	0.367	0.395	-0.036	-0.008	0.730	0.781	4267	2826
	G1215	Well	MDU	MDU	40	38	0.766	0.649	1.228	1.749	-0.113	-0.635	0.709	0.565	4219	2381
	G1220	Well	MDU	MDU	35	37	0.792	0.824	0.372	0.328	-0.191	-0.091	0.707	0.803	4336	2838
	G1221	Well	MDU	MDU	33	35	0.529	0.609	0.485	0.405	0.032	0.071	0.494	0.591	4308	2231
	G1222	Well	LDU	MDU	31	30	0.518	0.713	0.507	0.558	-0.105	-0.335	0.485	0.550	2678	1095
	G1223	Well	MDU	MDU	31	34	0.709	0.716	0.411	0.459	0.029	0.059	0.544	0.506	4349	2634
	G1224	Well	MDU	MDU	32	37	0.838	0.856	0.389	0.391	0.100	0.125	0.647	0.747	4296	2854
	G1225	Well	MDU	MDU	31	34	0.862	0.862	0.316	0.358	0.048	0.016	0.858	0.861	4322	2721
	G1316	Well	HDU	HDU	39	36	0.455	0.713	0.556	0.364	-0.072	-0.148	0.260	0.523	4191	1760
	G1472	Well	MDU	MDU	30	37	0.762	0.810	0.384	0.399	-0.118	0.005	0.712	0.806	3529	1095

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Table 4.2.2.1 (*cont.*) Calibration and Verification Statistics for the WCAs, ENP, BCNP, Holey Land and Rotenberger Water Management Areas, and the LECSAs. The yellow highlights indicate LEC Cutback Trigger Locations.

Basin/Region	Station	Gage Type (1)	Land Use Type (2)		SFWMM		R^2		RMSE (ft.)		BIAS (ft.)		Efficiency		Sample Size	
			Calib.	Verif.	Row	Col	Calib.	Verif.	Calib.	Verif.	Calib.	Verif.	Calib.	Verif.	Calib.	Verif.
LEC-SA2	G1473	Well	MDU	MDU	30	37	0.805	0.796	0.378	0.409	0.090	-0.010	0.711	0.752	4361	2903
	G1636	Well	LDU	LDU	29	30	0.625	0.637	0.450	0.574	-0.302	-0.379	0.244	-0.067	4293	2890
	G1637	Well	RS4	RS4	29	28	0.692	0.521	0.485	0.508	0.312	0.244	0.464	0.316	4219	2764
	G2031	Well	MDU	MDU	39	33	0.576	0.396	0.438	0.493	-0.134	0.010	0.462	0.074	4350	2922
	G2032	Well	LDU	LDU	35	32	0.429	0.367	0.536	0.604	0.218	0.231	0.208	-0.195	4320	2839
	G2033	Well	HDU	HDU	37	33	0.462	0.518	0.496	0.430	0.102	0.078	0.344	0.303	4306	2835
	G2034	Well	LDU	MDU	31	30	0.538	0.610	0.465	0.429	-0.163	0.121	0.409	0.541	4291	2813
	G2035	Well	MDU	MDU	31	36	0.801	0.786	0.627	0.636	-0.454	-0.429	0.104	0.352	4308	2922
	G2147	Well	MDU	MDU	39	39	0.607	0.510	0.896	1.155	0.275	0.062	0.562	0.508	4296	2858
	G2275	Well	MDU	MDU	37	37	0.725	0.852	0.602	0.566	0.079	0.358	0.713	0.740	1040	859
	G2376	Well	RS5	RS5	35	28	0.700	0.574	0.378	0.312	-0.082	0.099	0.682	0.522	4092	494
	G2443	Well	MDU		38	36	0.645		0.519		0.322		0.419		2895	
	G2444	Well	MDU		37	36	0.732		0.686		0.233		0.560		2789	
	G54HW	Canal	CNL	CNL			0.054	0.012	0.549	0.701	0.229	0.052	-0.527	-0.289	4346	2922
	G561	Well	HDU	HDU	34	37	0.780	0.789	0.357	0.349	-0.100	0.026	0.715	0.756	4291	2850
	G57HW	Canal	CNL	CNL			0.120	0.000	0.185	0.348	-0.021	0.066	-1.053	-0.680	1835	1826
	G616	Well	MDU	MDU	40	34	0.536	0.653	0.752	1.366	-0.001	-0.619	0.511	0.541	3618	681
	G617	Well	LDU	LDU	33	31	0.437	0.552	0.445	0.443	0.041	0.050	0.219	0.477	4383	2834
	G820A	Well	MDU		37	37	0.853		0.574		-0.321		0.785		4085	
	G970	Well	LDU	LDU	29	30	0.572	0.518	0.347	0.514	-0.074	-0.154	0.294	-0.102	4161	2738
	S13HW	Canal	CNL	CNL			0.086	0.209	0.300	0.277	-0.112	-0.072	-0.740	-0.271	4383	2922
	S29HW	Canal	CNL	CNL			0.035	0.001	0.284	0.324	0.030	0.016	-0.240	-0.330	4283	2922
	S30HW	Canal	CNL	CNL			0.587	0.205	0.613	0.502	0.167	0.118	0.515	0.136	3136	1827
	S329	Well	MDU	MDU	34	35	0.719	0.731	1.576	1.194	1.426	1.019	-0.575	0.003	4266	2900
	S33HW	Canal	CNL	CNL			0.449	0.129	0.276	0.344	0.011	-0.031	0.331	-0.505	4383	2922
	S36HW	Canal	CNL	CNL			0.049	0.035	0.305	0.322	-0.083	-0.010	-0.258	-0.253	4383	2889
	S37AHW	Canal	CNL	CNL			0.000	0.155	0.250	0.245	0.010	0.089	-0.322	-0.007	4383	2922
	S37BHW	Canal	CNL	CNL			0.021	0.016	0.279	0.353	0.052	-0.070	-0.473	-0.425	4373	2922
	S9HW	Canal	CNL	CNL			0.659	0.650	0.567	0.697	-0.289	-0.400	0.172	-0.068	4380	2891
	S9XNHW	Canal		CNL				0.384		0.330		-0.111		0.239		1214
LEC-SA3	C2.74	Canal	CNL	CNL			0.884	0.511	0.492	0.415	0.139	-0.155	0.848	0.416	4122	1715
	EVER1	Marsh	MLP	MLP	7	29	0.590	0.515	0.477	0.520	-0.189	-0.092	-1.384	-2.298	3441	1687
	EVER2B	Marsh	MLP	MLP	7	27	0.728	0.724	0.369	0.328	-0.142	-0.052	0.430	0.492	3647	1755
	EVER3	Marsh	MLP	MLP	8	26	0.794	0.841	0.221	0.158	0.076	-0.012	0.766	0.833	3347	1772
	EVER4	Marsh	MLP	MLP	8	25	0.846	0.909	0.251	0.206	0.096	0.032	0.752	0.750	3213	1793
	F179	Well	HDU	HDU	22	34	0.763	0.781	0.353	0.365	-0.206	-0.169	0.626	0.697	4383	2907
	F319	Well	MDU	MDU	20	33	0.698	0.567	0.386	0.437	0.149	0.123	0.139	0.099	4263	2857
	F358	Well	MDU	MDU	12	27	0.817	0.805	0.408	0.444	-0.041	0.021	0.653	0.684	4383	2844
	F45	Well	HDU	HDU	24	35	0.823	0.855	0.296	0.307	-0.039	-0.022	0.816	0.848	4354	2909
	FROGP	Well	ROW	ROW	11	24	0.716	0.638	0.353	0.436	0.050	-0.067	0.696	0.611	4120	1827
	G1166	Well	LDU	LDU	27	31	0.588	0.553	0.231	0.262	-0.015	0.021	0.586	0.549	4339	2597
	G1183	Well	HDU	HDU	13	30	0.582	0.580	0.384	0.402	-0.059	0.006	0.373	0.361	4201	2791
	G1251	Well	MLP	MLP	7	24	0.788	0.806	0.414	0.385	-0.140	-0.131	0.486	0.412	4383	2577
	G1362	Well	ROW	ROW	17	28	0.762	0.792	0.431	0.427	0.179	0.127	0.681	0.749	4246	2768
	G1363	Well	CIT	CIT	15	26	0.829	0.846	0.457	0.457	0.249	0.209	0.714	0.767	4346	2909
	G1486	Well	MDU	MDU	13	28	0.819	0.785	0.388	0.437	0.062	0.011	0.603	0.566	4322	2894

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			Calib.	Verif.	Row	Col	Calib.	Verif.	Calib.	Verif.	Calib.	Verif.	Calib.	Verif.	Calib.	Verif.
LEC-SA3	G1487	Well	ROW	ROW	19	27	0.701	0.527	0.573	0.476	-0.314	-0.222	0.566	0.385	4296	2020
	G1488	Well	RS5	RS5	24	27	0.765	0.864	0.544	0.441	-0.109	-0.150	0.663	0.701	4220	2863
	G211HW	Canal	CNL	CNL			0.731	0.117	0.430	0.340	0.115	-0.113	0.690	-0.288	1822	1827
	G3264A	Well	MEL	MEL	25	30	0.854	0.655	0.395	0.450	-0.084	0.025	0.845	0.647	4136	1710
	G3327	Well	HDU	HDU	23	34	0.501	0.687	0.348	0.302	0.023	0.146	0.495	0.590	4263	1692
	G3328	Well	HDU	HDU	23	34	0.538	0.691	0.276	0.248	-0.062	-0.061	0.425	0.573	4225	1785
	G3329	Well	MDU	MDU	23	32	0.566	0.616	0.442	0.512	0.120	0.281	0.158	0.081	4314	1773
	G3353	Well	MLP	MLP	6	24	0.779	0.749	0.292	0.287	0.026	-0.028	0.627	0.493	3663	1794
	G3354	Well	MLP	MLP	7	26	0.838	0.850	0.240	0.228	-0.138	-0.155	0.752	0.719	3305	1704
	G3439	Well	MEL	MDU	21	28	0.808	0.734	0.437	0.525	0.156	0.360	0.780	0.453	3017	1558
	G553	Well	MDU	MDU	18	31	0.842	0.741	0.542	0.604	-0.303	-0.248	0.496	0.322	3935	2762
	G580A	Well	LDU	MDU	19	32	0.733	0.657	0.392	0.442	0.047	0.078	0.510	0.442	4334	2905
	G596	Marsh	ROW	ROW	18	26	0.693	0.626	0.548	0.508	0.298	-0.032	0.558	0.624	4273	2922
	G613	Marsh	ROW	ROW	10	26	0.662	0.669	0.369	0.392	0.167	0.082	0.483	0.352	4314	2886
	G614	Well	CIT	CIT	15	28	0.807	0.819	0.494	0.471	0.335	0.140	0.624	0.768	4247	2818
	G757A	Well	ROW	ROW	16	27	0.773	0.812	0.410	0.421	0.127	0.043	0.720	0.773	4282	2860
	G789	Well	CIT	ROW	12	25	0.701	0.755	0.374	0.420	0.018	-0.101	0.696	0.739	4162	2894
	G852	Well	MDU	MDU	27	36	0.638	0.648	0.375	0.486	-0.033	-0.217	0.572	0.499	4178	2916
	G855	Well	MDU	HDU	19	28	0.719	0.727	0.511	0.508	0.038	0.007	0.591	0.599	4162	2876
	G858	Well	HDU	HDU	18	29	0.675	0.806	0.524	0.568	-0.112	0.033	0.551	0.484	3415	1095
	G860	Well	LDU	MDU	17	32	0.648	0.517	0.406	0.455	-0.124	-0.094	0.356	0.216	4383	2918
	G864	Well	CIT	ROW	11	26	0.757	0.751	0.388	0.450	0.000	-0.084	0.739	0.721	4380	2922
	G973	Well	MDU	HDU	26	31	0.654	0.556	0.379	0.370	0.178	0.127	0.557	0.477	4300	2883
	G975	Well	RS5	RS5	26	27	0.658	0.744	0.918	0.786	0.647	0.591	0.180	0.100	4142	2908
	G976	Well	MEL	MEL	24	28	0.797	0.528	0.862	0.713	0.363	-0.281	0.623	0.390	4213	2898
	S118HW	Canal	CNL	CNL			0.825	0.695	0.321	0.406	-0.048	-0.098	0.754	0.522	4376	2922
	S119HW	Canal	CNL	CNL			0.844	0.706	0.480	0.632	-0.212	-0.293	0.513	-0.075	4345	2922
	S123HW	Canal	CNL	CNL			0.563	0.201	0.410	0.472	-0.087	-0.004	0.231	-0.393	3437	1818
	S148HW	Canal	CNL	CNL			0.269	0.310	0.724	0.738	0.062	0.110	0.145	0.235	4221	2875
	S149HW	Canal	CNL	CNL			0.507	0.416	0.406	0.407	0.068	0.067	0.461	0.271	4334	1789
	S165HW	Canal	CNL	CNL			0.507	0.653	0.459	0.385	0.068	0.008	0.491	0.652	4327	2915
	S166HW	Canal	CNL	CNL			0.793	0.802	0.461	0.468	0.288	0.252	0.419	0.430	4383	2922
	S167HW	Canal	CNL	CNL			0.623	0.619	0.421	0.484	0.083	0.109	0.577	0.584	4383	2922
	S176HW	Canal	CNL	CNL			0.717	0.593	0.335	0.425	0.077	-0.060	0.679	0.583	4383	2922
	S177HW	Canal	CNL	CNL			0.518	0.383	0.368	0.428	0.077	0.047	0.460	0.349	4383	2698
	S179HW	Canal	CNL	CNL			0.725	0.679	0.340	0.394	0.022	-0.018	0.520	0.352	4378	2922
	S18	Marsh	MDU	MDU	28	34	0.698	0.737	0.249	0.257	0.101	0.043	0.630	0.720	4328	2740
	S182	Well	MDU	MDU	16	31	0.633	0.667	0.377	0.419	-0.190	-0.190	0.322	0.496	4332	2796
	S18CHW	Canal	CNL	CNL			0.646	0.577	0.242	0.316	0.029	-0.098	0.640	0.200	4380	2922
	S196A	Well	CIT	ROW	13	26	0.836	0.838	0.367	0.377	0.201	0.142	0.754	0.809	4337	2900
	S197HW	Canal	CNL	CNL			0.789	0.645	0.333	0.350	-0.235	-0.214	0.532	0.299	4233	2733
	S20FHW	Canal	CNL	CNL			0.203	0.126	0.378	0.497	-0.102	-0.150	-0.771	-1.908	3750	2206
	S21AHW	Canal	CNL	CNL			0.283	0.175	0.268	0.314	0.055	0.053	0.097	-0.337	4375	2922
	S21HW	Canal	CNL	CNL			0.112	0.040	0.283	0.317	-0.090	-0.001	-0.546	-1.066	4383	2922
	S22HW	Canal	CNL	CNL			0.421	0.230	0.478	0.491	-0.148	-0.193	-0.035	-0.489	4366	2922
	S25HW	Canal	CNL	CNL			0.191	0.010	0.243	0.264	-0.087	-0.095	-0.460	-1.645	3910	2346

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Table 4.2.2.1 (*cont.*) Calibration and Verification Statistics for the WCAs, ENP, BCNP, Holey Land and Rotenberger Water Management Areas, and the LECSAs. The yellow highlights indicate LEC Cutback Trigger Locations.

Basin/Region	Station	Gage Type (1)	Land Use Type (2)		SFWMM		R^2		RMSE (ft.)		BIAS (ft.)		Efficiency		Sample Size	
			Calib.	Verif.	Row	Col	Calib.	Verif.	Calib.	Verif.	Calib.	Verif.	Calib.	Verif.	Calib.	Verif.
LEC-SA3	S26HW	Canal	CNL	CNL			0.051	0.027	0.345	0.379	0.106	0.108	-0.174	-0.115	3755	1827
	S27HW	Canal	CNL	CNL			0.073	0.173	0.237	0.246	-0.025	-0.093	-0.196	-0.029	4299	2922
	S28HW	Canal	CNL	CNL			0.059	0.017	0.215	0.281	-0.063	-0.138	-0.183	-0.776	4383	2922
	S335HW	Canal	MDU	HDU			0.639	0.610	0.681	0.486	-0.014	0.282	0.416	0.383	4383	1868
	S331HW	Canal	CNL	CNL			0.352	0.088	0.510	0.552	-0.048	-0.199	0.263	-0.356	4369	2231
L8	PB831	Well	FUP	FUP	60	29	0.683	0.759	0.637	0.687	0.044	-0.237	0.556	0.500	4219	2864

Notes: **(1) Statistics for canal stages are derived from a smoothed trace (7-day moving average)**

(3) Denotes LEC Cutback Trigger Location

(2) Land Use Legend

Code	Description
LDU	Low Density Urban
CIT	Citrus
MAR	Freshwater Marsh
SAW	Sawgrass
WET	Wet Prairie
SHR	Shrubland (includes Rangeland)
ROW	Row Crops
SUG	Sugar Cane
IRR	Irrigated Pasture
STA	Stormwater Treatment Area (with dense vegetation)
HDU	High Density Urban
FWT	Forested Wetland
MAN	Mangroves
MEL	Melaleuca
CAT	Cattail
FUP	Forested Uplands
RS1	Ridge & Slough 1
MLP	Marl Prairie
MIX	Mixed Cattail-Sawgrass
WAT	Open Water
RS2	Ridge & Slough 2
RS3	Ridge & Slough 3
RS4	Ridge & Slough 4
RS5	Ridge & Slough 5
MDU	Medium Density Urban
CNL	Canal

4/6/2004

Table 4.2.2.1 (*cont.*) Calibration and Verification Statistics for the WCAs, ENP, BCNP, Holey Land and Rotenberger Water Management Areas, and the LECSAs.

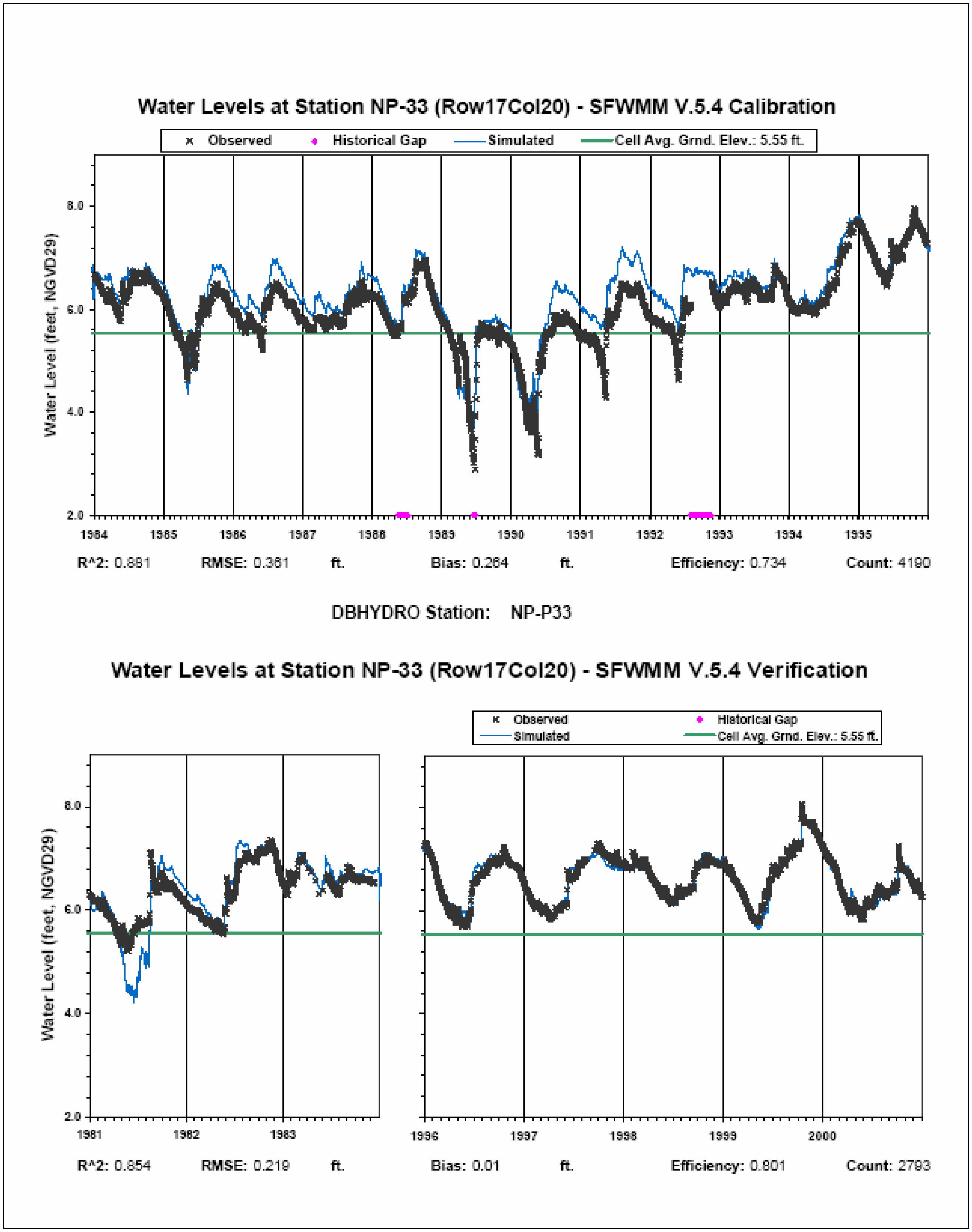

Figure 4.2.2.1 Example Time Series Figures for Water Level Calibration and Verification

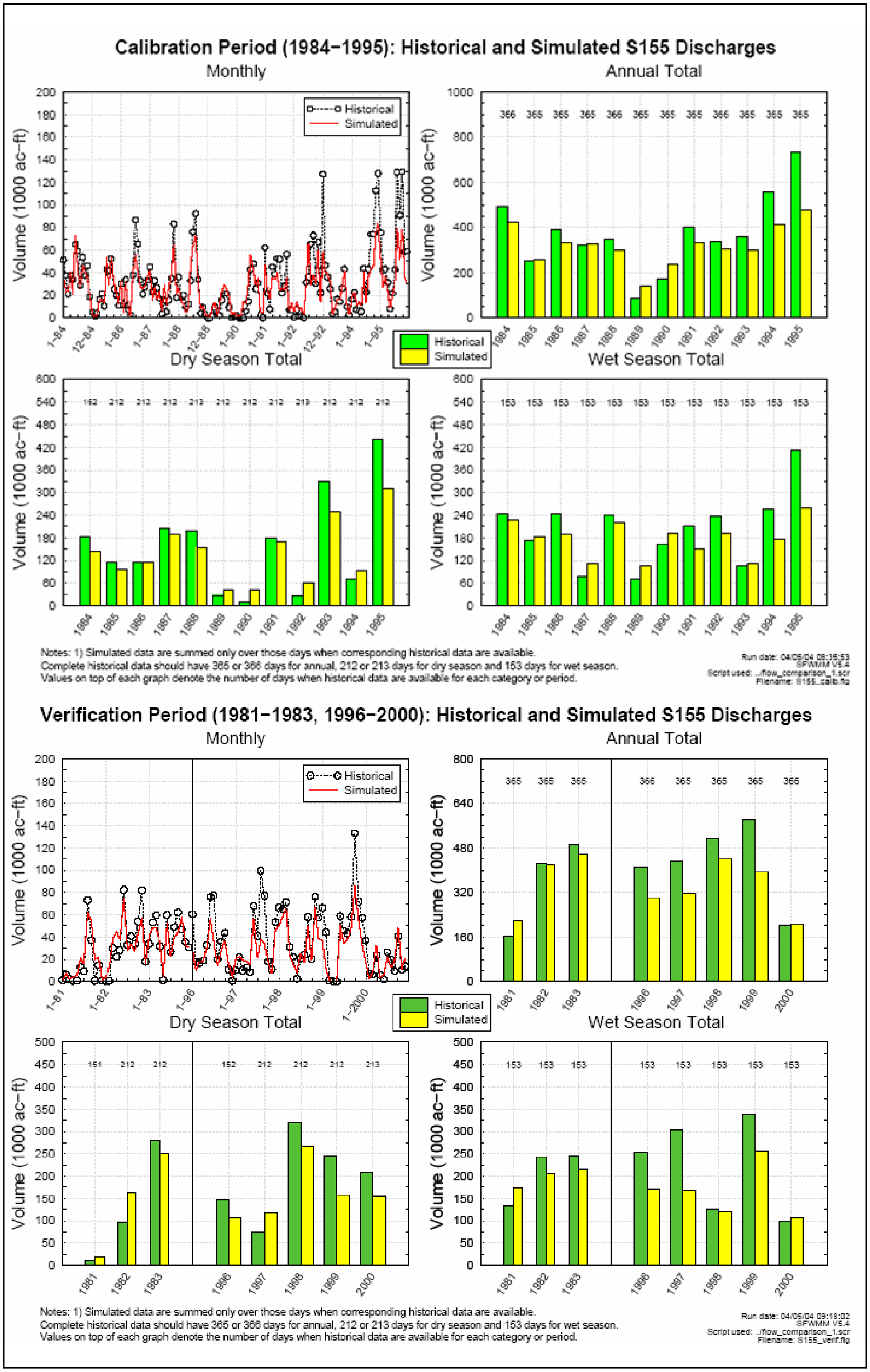

Figure 4.2.2.2 Example Time Series Figures for Flow Validation
(Used Only as a Reasonability Check)

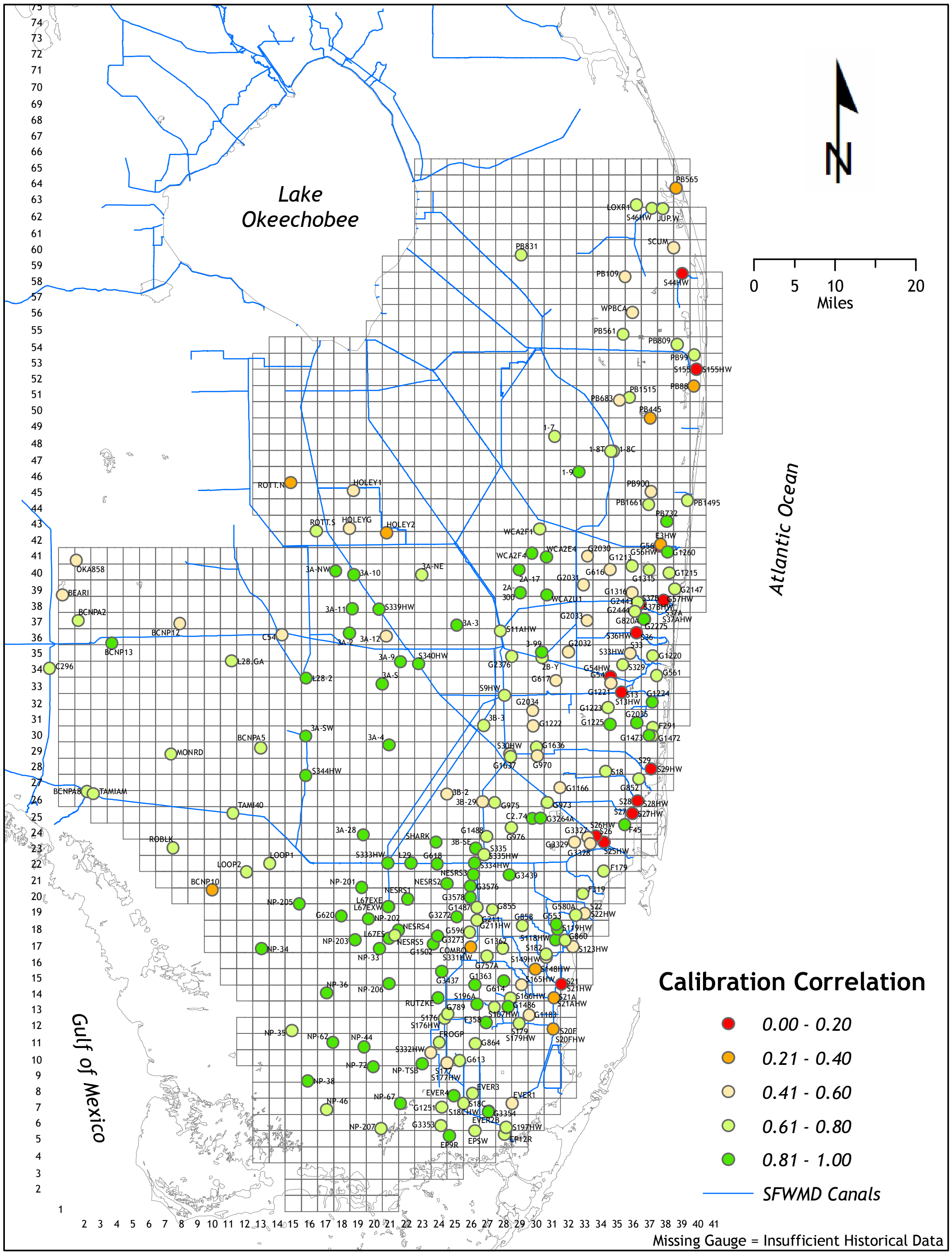

Figure 4.2.2.3 Calibration Correlation

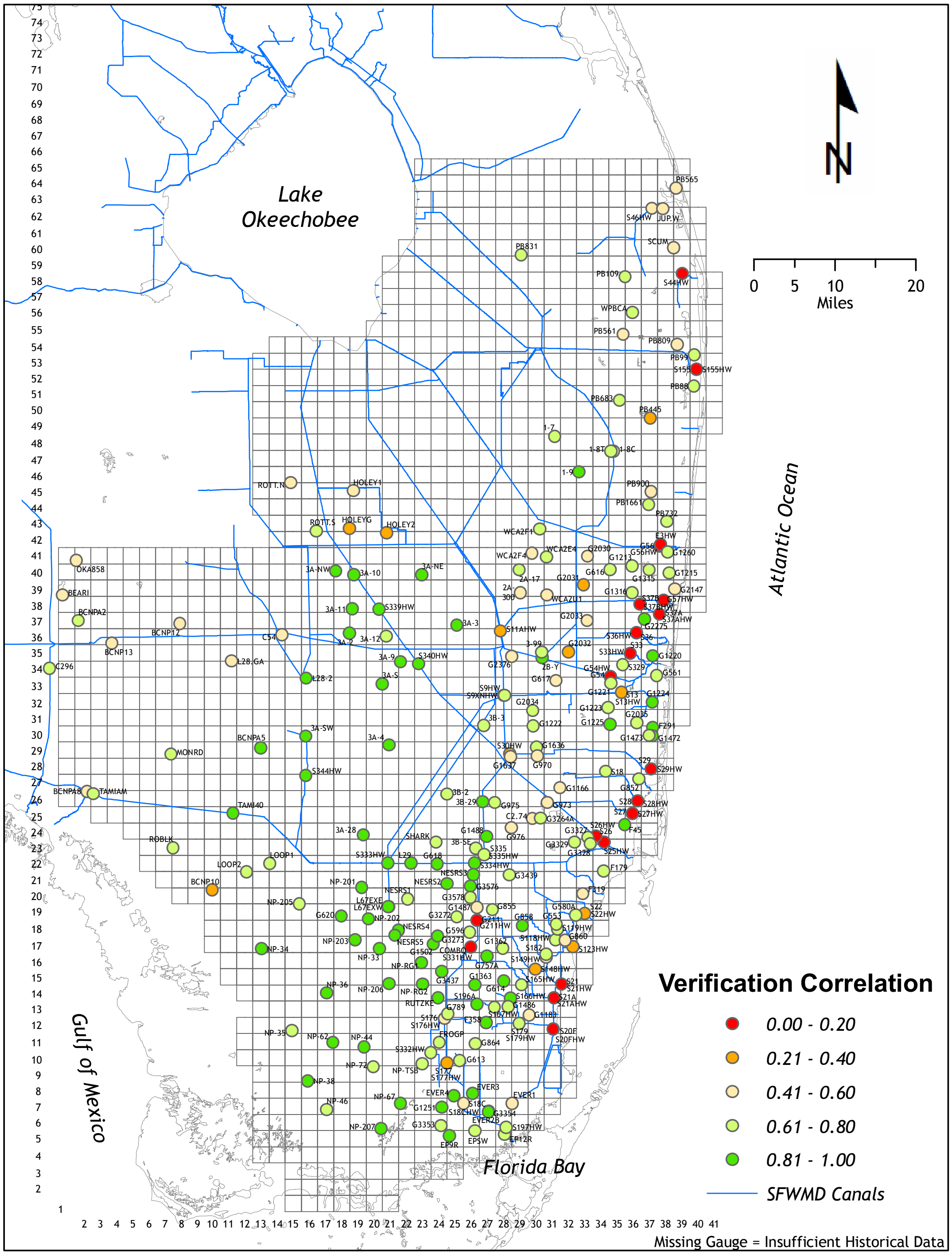

Figure 4.2.2.4 Verification Correlation

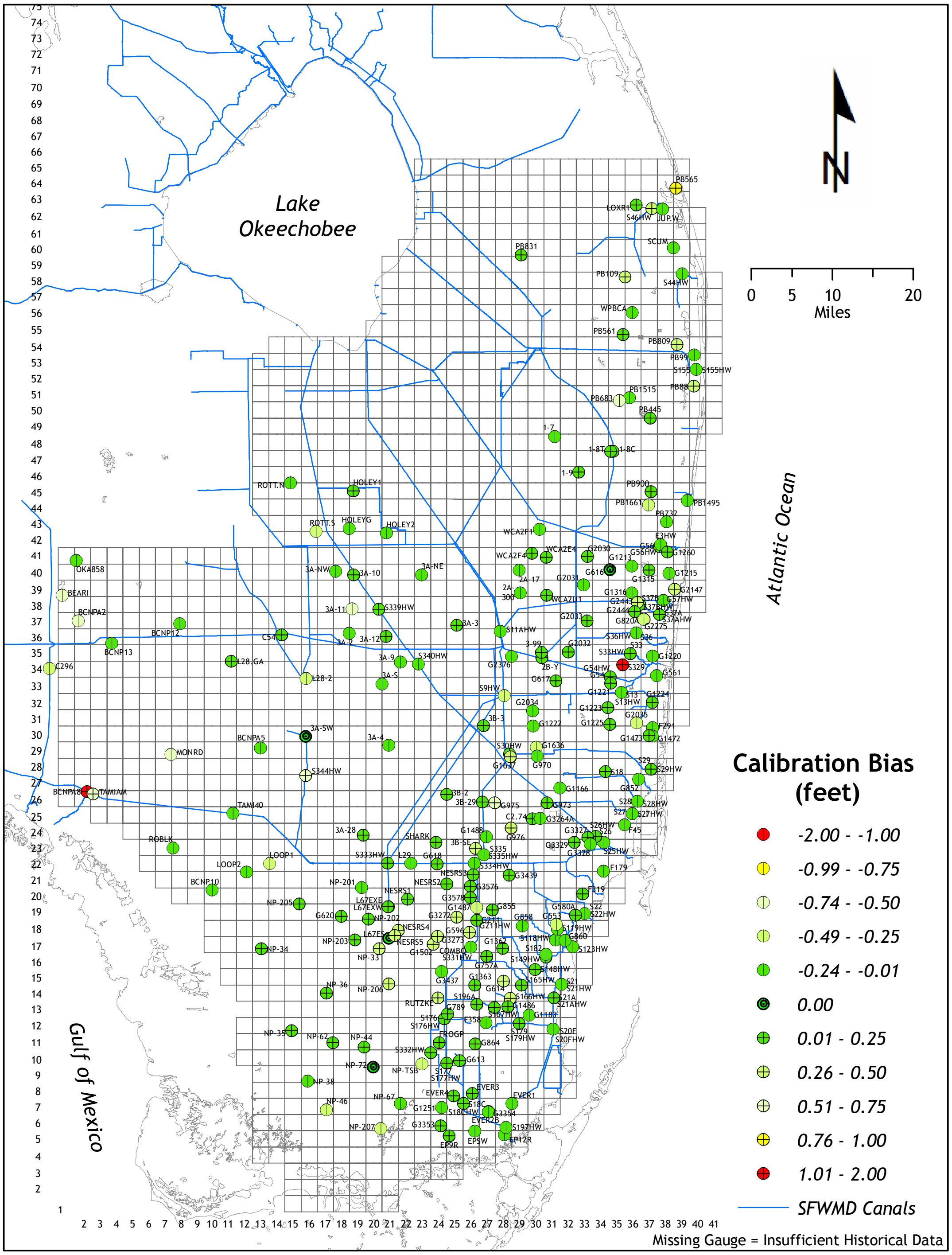

Figure 4.2.2.5 Calibration Bias

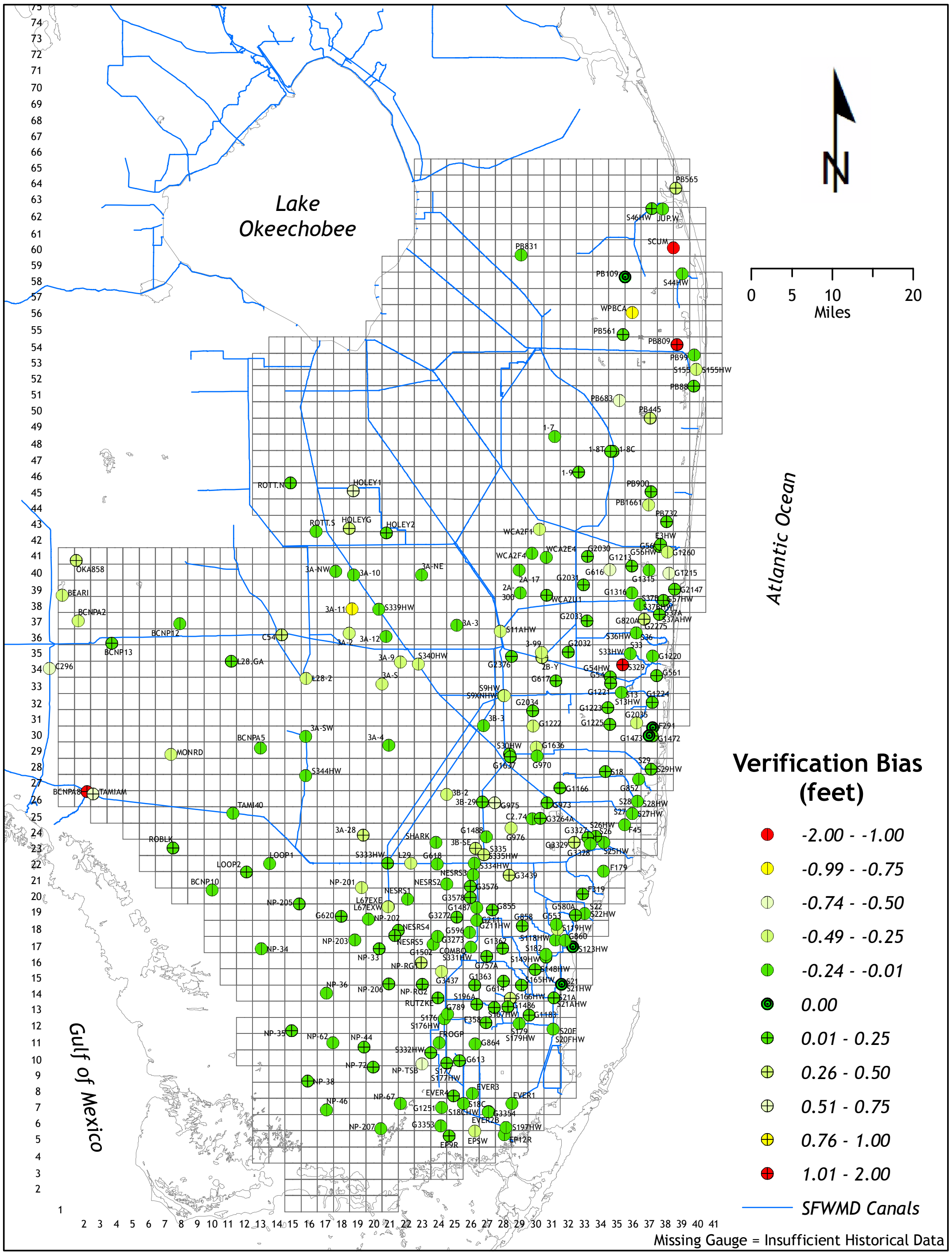

Figure 4.2.2.6 Verification Bias

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